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Management of

BROMEGRASS for SEED in central Saskatchewan



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PROPER MANAGEMENT GIVES HIGHEST RETURN

Many fields in Saskatchewan have produced brome-grass for more than 20 years without reseeding. Periodic cultivation and nitrogen fertilizers help maintain high yields of forage and seed.

Cultivation, especially plowing, increases seed yields. If you plow every four years you can more than double your average yields, even though you lose a year's production. Tillage does not consistently increase hay yields but fertilizer usually does. Whether you should plow in spring or fall depends largely on the weather. Seeding oats after plowing reduces the yields.

Nitrogen fertilizer broadcast on rejuvenated fields will substantially increase your seed yields. The type of fertilizer and the time and rate of application are important:

1. If equal amounts of nitrogen are applied, ammonium nitrate (33.5-0-0) will produce as high or higher seed yields than ammonium sulphate (21-0-0) or ammonium phosphate (16-20-0 or 27-14-0). There is no apparent benefit from the addition of phosphate.
2. Fertilizer gives higher seed yields when applied in the fall than when applied in early spring. A mid-September application is better than one in mid-August or mid-October. Time of application has little bearing on hay production.
3. In tests at Scott from 1958 to 1959, the most profitable rate of application of ammonium nitrate was about 100 pounds per acre.

Fertilizers are more desirable than tillage for improving seed yields of named varieties because tillage may change the characteristics of the varieties. For example, rejuvenation of the Parkland variety by plowing causes a considerable increase in its creeping-rooted habit. Although named varieties of brome-brass are grown to a limited extent in Saskatchewan now, new varieties now available will be grown more widely in the future. It is not yet known whether fertilizers alter strains; if they do, the effect is probably less than that caused by tillage. To rejuvenate named varieties for hay, either tillage or fertilizer is satisfactory.

Management of BROMEGRASS for SEED in central Saskatchewan

W.L. Crowle¹ and R.P. Knowles²

Bromegrass is a major forage seed crop in Western Canada. The average seed production in Canada for the years 1941 to 1959 was about 9 million pounds annually. From 1950 to 1959, 93 percent of the total came from Alberta and Saskatchewan. Saskatchewan's share, 37 percent of the total, was grown mainly in the central area. Here seed production is concentrated on the lighter-textured soils in the dark-brown soil zone, in the Unity-Cutknife-Wilkie area.

Seed yields of bromegrass usually drop off after three to five years. Most farmers, therefore, rejuvenate stands by plowing or one-way disking. They get no seed crop that year and to use the land some farmers seed a cereal crop such as oats.

Although grown primarily for seed, bromegrass also provides much feed. After seed harvest, farmers often feed the straw to livestock as hay or leave it in the field for pasturing. When seed prices are low, or feed is scarce, the crop may have to be used only as feed.

VARIETIES

Practically all bromegrass seed grown in Western Canada is of the northern type; very little is from named varieties. Most of the seed is exported to the United States and it is generally marketed as Certified Couch Free or Commercial. Many fields seeded in the late thirties and early 'forties are still producing.

The northern variety Carlton, released in 1961, gives higher yields than Commercial and is expected to replace it in many areas. Southern strains such as Lincoln, Fischer and Achenbach yield less seed than Commercial.

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REJUVENATING STANDS

To keep seed yields high, rejuvenate your stands periodically. Though you generally lose one year's crop, you may double or triple your average annual yield (Tables 1 & 2). Tillage and fertilizing each have advantages as methods of rejuvenation, or you may combine them.

The above recommendation is based on studies from 1948 to 1960 at the Research Station at Saskatoon to evaluate rejuvenation practices and other possible ways of increasing production. The soil was silty clay loam of the Elstow association.

The first test involved eight fertilizer and plowing treatments on brome-grass grown alone and a brome-alfalfa mixture. Hay and seed yields were recorded for brome-grass alone, but hay yields only for the mixture. Although plots rejuvenated by plowing gave no seed the following year, the yields in Table 1 are averages of the total yields for the four-year period.

The second test involved tillage and fertilizer treatments alone and in combination. Fall plowing was done in October and spring plowing in late April. Plots were disked down and packed after plowing and one-waying. Oats was seeded into worked sod for four of the treatments and harvested as grain. The grass was mowed in early August when seed was approaching maturity. Total weight was based on the hay yield and the crop was then threshed for seed. The yields in Table 2 are averages of total seed yields for the eight years. No allowance was made for the loss of a seed crop after plowing.

Tillage

Plowing brome sod every four years will give you higher average seed yields than other tillage even though you lose one year's crop. Plowing does not affect your hay yields appreciably. If you plow a mixture of brome-grass and alfalfa, however, especially in the fall, the alfalfa may be seriously killed. Milder forms of tillage, such as one-waying and narrow-tooth cultivating, will give you lower yields than plowing, but stands are less likely to be killed out. Rototilling old stands into rows appears to have little value.

Oats after Plowing

Do not seed oats after plowing. Oat yields are generally poor, and you can expect reduced seed yields from your next brome-grass crop. As Table 2 shows, oats was seeded into worked sod for four of the treatments and harvested as grain. The yields of oats were low, averaging 30, 8, 0, and 0 bushels per acre for the years 1953, 1954, 1957, and 1959, respectively.

Fertilizers

Nitrogen fertilizers alone will increase your seed yields but are not nearly as effective as good tillage. Hay yields, however, respond more to nitrogen fertilizers than tillage.

FERTILIZING AFTER TILLAGE

From 1951 to 1959, a number of fertilizer trials were conducted on brome-grass fields in the Unity-Wilkie area of Saskatchewan. Most of the fields had produced at least one seed crop after tillage but not more than four. As moisture is the major factor affecting production, monthly and seasonal precipitation records for the years concerned are given in Table 3. Seasonal precipitation is shown both for the immediate growing season, April to July, and for the longer period, from the preceding August to July, to include fall moisture.

Rates and Dates

Twenty-five tests were conducted from 1951 to 1957 to compare three nitrogen fertilizers. Ammonium nitrate (33.5-0-0), ammonium sulphate (21-0-0) and ammonium phosphate (16-20-0) were applied at 120, 200 and 262 pounds per acre, respectively. Each of these rates applied 40 pounds of nitrogen. Ammonium nitrate was also applied at 60 and 240 pounds. Each fertilizer was applied in mid-September, mid-October and mid-April.

Seed yields.— As Table 4 shows, average seed yields are similar when the same amount of nitrogen is applied, whether as ammonium nitrate, ammonium sulphate or ammonium phosphate. Apparently the addition of phosphate or sulphur is no better than nitrogen alone.

Based on seven-year averages, mid-September applications of ammonium nitrate at 60, 120 and 240 pounds per acre increased the seed yields by 64.5, 94.3 and 145.8 percent, respectively. Since these increases are not in direct proportion to the amount of fertilizer applied, your most profitable rate would depend on the market price for seed, the cost of fertilizer and the yield level for the particular year.

Based on six-year averages, all fertilizers produced 41 percent more seed when applied in mid-September than when applied in mid-April. Based on five-year averages, the mid-September applications of fertilizer produced 12.7 percent more than the equivalent mid-October applications.

You can compare seed yields in Table 4 with precipitation in Table 3 to check how effective fertilizers are under the moisture conditions in a particular year. It is evident that fertilizer increases seed yields in dry years (such as 1953 and 1957) as well as in years when moisture conditions are favorable. It is debatable, however, whether an increase of 39 to 86 pounds per acre (as obtained in 1957 from a mid-September application of 120 pounds per acre of ammonium nitrate) would be profitable.

Hay yields.— Since brome grass fields are often cut for hay or grazed after the seed harvest, farmers are interested in the effect fertilizers have on forage production. To find out, total forage production was measured after seed harvest from 25 of the seed-production tests.

The results (Table 5) show that when the three fertilizers are applied to give equal rates of nitrogen the yields of hay are about equal. Ammonium nitrate produces just a bit more than the others.

Based on seven-year averages, the 60-, 120- and 240- pound applications of ammonium nitrate increased yields by 37, 70 and 95 percent, respectively. Although 120 pounds increased yields much more than 60 pounds, it is evident that applications of 240 pounds per acre would cost too much.

The date of application has very little effect on hay yields. In the tests, fertilizers produced an average of only $4\frac{1}{2}$ percent more forage when applied in mid-September than when applied in mid-April, and only 3 percent more than when applied in mid-October.

Financial Returns

An attempt was made to find the actual gains the various fertilizer treatments gave. Pounds of seed and pounds of dry matter produced by each pound of nitrogen were calculated.

The results (Table 6) show that the highest proportional increase in seed production is from a mid-September application of ammonium nitrate at 60 pounds per acre. Hay gains for applications of 60 and 120 pounds per acre in mid-September are almost identical. The 240-pound rate is less efficient than the lower rates.

Prevailing seed prices are important in determining your best rates of fertilizer application. To illustrate, 60 and 120 pounds of ammonium nitrate contain 20 and 40 pounds of nitrogen, respectively. As shown in Table 6 you can expect these applications to produce additional quantities of 69.2 (3.46×20) pounds and 101.2 (2.53×40) pounds of seed per acre when applied in mid-September. The cost of ammonium nitrate in the area is about \$4.20 for 100 pounds, or 12.5 cents per pound of nitrogen. Assuming that brome grass seed sold at six cents a pound, the profits above fertilizer cost for the 60- and 120-pound rates would be \$1.65 and \$1.07, respectively. At 12 cents a pound for seed the profits would be \$5.80 and \$7.15 for the 60- and 120-pound rates. Thus, with higher seed prices,

you can profitably use higher rates of fertilizer application. The value of your forage after the seed harvest has not been considered in these calculations. You can use the same method to predict the additional profits for hay production which would of course favor somewhat higher application rates.

A test was started in 1957 to include additional rates of application of ammonium nitrate with each rate applied on three separate dates. The mid-April application used in previous tests was replaced by a mid-August application. A phosphate fertilizer with a higher nitrogen content (27-14-0) replaced 16-20-0. The yields in Table 7 are averages for six identical tests harvested in 1958 and 1959.

The results again indicate that a mid-September application of ammonium nitrate (33.5-0-0) is better than a mid-October application and may be somewhat better than a mid-August application. Ammonium sulphate and ammonium phosphate show no advantage over ammonium nitrate.

Profits per acre above fertilizer costs were calculated from actual farm seed prices and fertilizer costs in the area. The average price of seed for 1958 - 1959 was 9 cents a pound, which is close to the long-term average. The prices for ammonium nitrate, ammonium sulphate and ammonium phosphate were \$83.70, \$59.45 and \$85.65 per ton, respectively. Average seed yields for the three application dates were used to calculate returns. Ammonium nitrate at 100 pounds per acre was the most profitable treatment.

USEFUL PUBLICATIONS

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Table 1— Hay and seed yields per acre of brome grass after plowing and fertilizer treatments, Saskatoon, 1951 - 1954 averages

Treatment	Seed, pounds		Hay, tons	
	Brome alone	Brome & alfalfa	Brome alone	Brome & alfalfa
No treatment	45	0.98	0.50	0.98
Plowed in spring 1949, 1953	105	1.06	0.74	1.06
Manured, 6 tons per acre 1948, 1952	76	1.09	0.89	1.09
Plowed in fall 1948, 1952	148	0.86	0.79	0.86
Manured, 6 tons per acre, and plowed in fall. . . 1948, 1952	158	1.04	0.82	1.04
A.S. ¹ 100 lb. per acre	89	1.12	0.74	1.12
A.S. 300 lb. per acre	76	1.29	0.95	1.29
A.N. ² 187 lb. per acre	104	1.51	0.94	1.51

¹ Ammonium sulphate (21-0-0) applied annually in October.

² Ammonium nitrate (33-0-0) applied annually in October.

Table 2— Average hay and seed yields per acre after various fertilizer and tillage treatments, Saskatoon, 1952 – 1960

Treatment	Seed, pounds	Hay, tons
No treatment	76	0.55
Plowed in fall 1952, 1956	127	0.65
Plowed in spring 1953, 1957	162	0.59
1953, 1957, fertilized ¹	160	0.68
1953, 1957, seeded to oats	150	0.57
1953, 1957, seeded to oats, fertilized ¹	145	0.69
1954, 1959, seeded to oats	101	0.37
1954, 1959, seeded to oats, fertilized ¹	90	0.39
<i>Other tillage</i>		
One-way 1953, 1957 once over	102	0.55
1953, 1957 twice over	113	0.54
Narrow-tooth cultivator 1953, 1957	110	0.53
Rototilled into rows 3 ft. apart, annually	86	0.48
<i>Fertilizer</i>		
A.N. ² 62 lb. per acre	104	0.72
A.N. 125 lb.	118	0.88
A.N. 250 lb.	115	1.04

¹ Fertilized 125 lb. per acre ammonium nitrate September 1957, 1958, 1959.

² Ammonium nitrate (33.5-0-0) annually in September.

Table 3— Monthly and seasonal precipitation 1950 - 1959 and long-term averages in inches,
Experimental Farm, Scott

Period	1950-51	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	Average
August	1.26	2.23	.84	1.50	6.19	.46	.96	3.39	.46	
September	1.29	1.00	.91	.34	2.75	1.46	1.22	.97	1.39	
October	2.37	.92	.19	.15	.38	.34	.31	1.56	.10	
November	.86	.71	.52	.13	.83	.43	.16	.74	.79	
December	.81	.47	.18	.83	.46	1.76	1.16	.51	.62	
January	.64	.80	.76	.48	.90	.52	.13	.48	.14	
February	.56	.22	.36	.27	.13	1.15	.09	.49	.57	
March	.85	.91	1.56	.16	.81	1.30	.39	1.57	.30	
Fall and winter August - March	8.64	7.26	5.32	3.86	12.45	7.42	4.42	9.71	4.37	7.05
Long term August - March										6.90
April	1.39	.20	1.23	1.11	3.13	.28	.54	.45	.42	
May	2.27	2.21	1.92	1.58	.93	.60	.27	1.27	.71	
June	.73	4.19	.99	2.43	4.11	2.90	1.78	1.01	2.68	
July	4.19	2.77	2.32	3.00	2.64	1.23	1.65	2.85	1.00	
Growing season April - July	8.58	9.37	6.46	8.12	10.81	5.01	4.24	5.58	4.81	7.00
Long term April - July										6.90
Total	17.22	16.63	11.78	11.98	23.26	12.43	8.66	15.29	9.18	14.05
Long term total										13.80

Table 4—Seed yields in pounds per acre of bromegrass after nitrogen fertilizers were broadcast at three different times

Fertilizer application			Yields									
Fertilizer	Time (mid-month)	Pounds per acre	Year and number of tests conducted									
			1951 (5)	1952 (5)	1953 (2)	1954 (4)	1955 (3)	1956 (3)	1957 (3)	Seven- year 1951-57	Averages Six- year 1952-57	Five- year 1953-57
Check (not fertilized)			92	191	63	123	121	119	39	107	110	93
A.N. ¹	September	60	153	263	165	195	228	170	58	176	180	163
A.N.	September	120	224	303	177	220	276	171	86	208	206	186
A.N.	September	240	301	462	242	225	315	178	116	263	256	215
A.N.	October	120			158	245	232	150	74			172
A.N.	April	120	137	217	131	184	180	136	62	150	152	139
A.S. ²	September	200	194	301	174	221	261	176	72	200	201	181
A.S.	October	200			170	180	248	126	60			157
A.S.	April	200	116	213	89	198	182	106	52	136	140	125
A.P. ³	September	262		384	226	189	263	175	69		218	184
A.P.	October	262			196	208	209	120	64			159
A.P.	April	262		222	177	167	184	110	45		151	137

All fertilizer rates provided the equivalent of 40 lb. of N per acre except the 60- and 240-pound rates of A.N. (33.5-0-0).

¹ Ammonium nitrate (33.5-0-0).

² Ammonium sulphate (21-0-0).

³ Ammonium phosphate (16-20-0).

Table 5— Hay yields in tons per acre of bromegrass after nitrogen fertilizers were broadcast at three different times

Fertilizer application			Yields									
Fertilizer	Time (mid-month)	Pounds per acre	Year and number of tests conducted									
			1951 (5)	1952 (5)	1953 (2)	1954 (4)	1955 (3)	1956 (3)	1957 (3)	Seven- year 1951-57	Averages Six- year 1952-57	Five- year 1953-57
Check (not fertilized)			1.41	.98	.98	.71	.72	.63	.26	.81	.71	.66
A.N. ¹	September	60	2.22	1.22	1.33	.98	.93	.73	.36	1.11	.92	.87
A.N.	September	120	2.81	1.46	1.61	1.30	1.18	.88	.41	1.38	1.14	1.08
A.N.	September	240	3.21	1.59	1.85	1.50	1.35	1.06	.50	1.58	1.31	1.25
A.N.	October	120			1.46	1.16	1.06	.89	.36			.99
A.N.	April	120	2.63	1.38	1.42	1.18	1.09	.97	.44	1.30	1.08	1.02
A.S. ²	September	200	2.65	1.33	1.46	1.20	1.16	.93	.38	1.30	1.08	1.03
A.S.	October	200			1.46	1.24	1.02	.96	.42			1.02
A.S.	April	200	2.59	1.38	1.28	1.17	1.08	.89	.31	1.24	1.02	.95
A.P. ³	September	262		1.34	1.52	1.22	1.06	.86	.36		1.06	1.00
A.P.	October	262			1.50	1.32	.93	.93	.39			1.01
A.P.	April	262		1.37	1.32	1.20	1.07	1.06	.34		1.06	1.00

All fertilizer rates provided the equivalent of 40 lb. of N per acre except the 60- and 240-pound rates of A.N. (33.5-0-0).

¹ Ammonium nitrate (33.5-0-0).

² Ammonium sulphate (21-0-0).

³ Ammonium phosphate (16-20-0).

Table 6—Seed and hay yield increases in pounds per acre for each pound of nitrogen applied

Fertilizer application			Yield increase					
Fertilizer	Time (mid-month)	Pounds per acre	Seven-year av. Seed	Seven-year av. Hay	Six-year av. Seed	Six-year av. Hay	Five-year av. Seed	Five-year av. Hay
Check (not fertilized)								
A.N. ¹	September	60	3.46	29.6	3.52	21.2	3.51	20.6
A.N.	September	120	2.53	28.4	2.40	21.4	2.32	20.8
A.N.	September	240	1.94	19.2	1.83	14.8	1.52	14.8
A.N.	October	120					1.97	16.2
A.N.	April	120	1.06	24.4	1.06	18.4	1.14	18.0
A.S. ²	September	200	2.32	24.4	2.28	18.2	2.19	18.2
A.S.	October	200					1.59	18.0
A.S.	April	200	.74	21.4	.76	15.2	.80	14.2
A.P. ³	September	262			2.70	17.4	2.28	17.2
A.P.	October	262					1.65	17.6
A.P.	April	262			1.04	17.4	1.09	17.0

- ¹ Ammonium nitrate (33.5-0-0).
² Ammonium sulphate (21-0-0).
³ Ammonium phosphate (16-20-0).

Table 7—Seed yields in pounds per acre and profits from fertilizer for six tests in 1958 and 1959

Treatment Fertilizer and pounds applied per acre	Yields			Returns per acre above fertilizer cost
	August 15	September 15	October 15	
Check (not fertilized)	101	101	101	0
A.N. ¹ 40	146	157	135	\$2.38
A.N. 60	142	181	153	2.68
A.N. 80	175	175	170	3.16
A.N. 100	197	191	189	4.03
A.N. 120	211	199	184	3.71
A.S. ² 100	—	163	—	2.61
A.P. ³ 100	—	188	—	3.55
Average, A.N. only	174	181	166	

¹ Ammonium nitrate (33.5-0-0).² Ammonium sulphate (21-0-0).³ Ammonium phosphate (27-14-0).

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